

# Use of Dexamethasone and Local Hypothermia after Third Molars Surgery

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## Abstract

The aim of this study was to improve the treatment of inflammatory complications by topical application of dexamethasone and hypothermia alone and combined in patients after third molars surgery and determination of the most effective method.

Patients were of the age range of 18-30 years. Forty five patients, each of whom required removal of a single impacted mandibular third molar under local anaesthesia, were randomly allocated to 4 groups. The one experimental group were given dexamethasone 4 mg intramuscularly, another group – local hypothermia for three sessions a day, the third group was combined application of dexamethasone and hypothermia and the control group had no steroid. The local temperature and condition of blood flow in postoperative area were measured by an examiner preoperatively, at the first day of surgery, at 3, 7 and 10 days postoperatively.

Results of thermometric and reographical researches objectively demonstrate that the use of dexamethasone and hypothermia had positive affect of the normalization of the local temperature and blood supply of the postoperative tissue area, but the most effective were combined use of these methods of treatment.

Dexamethasone 4 mg given intramuscularly and local hypothermia is an effective way of stabilizing the temperature and blood flow of postoperative area after removal of impacted lower third molars. It offers a simple, safe, painless and cost-effective treatment in moderate and severe cases.

The most effective of all used methods was the combination of the local intramuscular administration of dexamethasone and application of local hypothermia, which confirms the results of thermometry and rheographic study.

**Keywords:** dexamethasone, hypothermia, third molars surgery, postoperative complications

## Introduction

The removal of impacted lower third molars is usually accompanied by considerable traumatization of the surrounding soft tissue, damage to the small blood vessels, which leads to the development of postoperative complications [1, 2]. The initial response to injury is vasospasm in paravulnar area, which is followed by their expansion. Under the influence of inflammatory mediators the vascular permeability is increased, and water and hemocytes comes out in the interstitial space, which

explains the occurrence of edema [3, 4]. Besides, the postoperative period is accompanied by pain and trismus of masticatory muscles.

There are various treatments methods for inflammatory postoperative complications, including the antibacterial, non-steroidal anti-inflammatory drugs, painkillers and steroids, as well as local application of cold [5, 6]. The clinical dental surgery commonly uses Dexamethasone and Methylprednisolone [7, 8]. Several authors studied the effectiveness of their application and noted that prescription of corticosteroids before, during or after surgery significantly reduces the severity of postoperative complications such as pain, swelling and trismus of masticatory muscles [9]. Dexamethasone may be administered intramuscularly, intravenously and orally in

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Table 1. Dynamics of changes in local thermometry values in the main and control groups (°C)

Day of the p/o period	First group (N = 10) (Control)		Second group (N = 11)			Third group (n = 11)			Fourth group (n = 13)		
	M±m	P <sub>1</sub>	M±m	P <sub>1</sub>	P <sub>2</sub>	M±m	P <sub>1</sub>	F <sub>2</sub>	M±m	P <sub>1</sub>	P <sub>2</sub>
Normal	34.2±0.13		34.2±0.13			34.2±0.13			34.2±0.13		
1	37.61±0.016	<0.05	36.85±0.013	<0.05	<0.05	36.95±0.007	<0.05	<0.05	36.00±0.007	<0.05	<0.05
3	36.50±0.009	<0.05	35.23±0.014	<0.05	<0.05	35.75±0.011	<0.05	<0.05	35.15±0.011	<0.05	<0.05
7	34.79±0.016	<0.05	34.5±0.1	>0.05	>0.05	34.61±0.014	>0.05	>0.05	34.01±0.01	>0.05	<0.05
10	34.5±0.2	>0.05	34.1±0.1	>0.05	>0.05	34.55±0.011	>0.05	>0.05	34.02±0.014	>0.05	<0.05

Note: P<sub>1</sub> - significance compared to the norm; P<sub>2</sub> - significance compared to the control group in the same period.

a tablet form (most commonly used). Depending on the treatment period, it is administered before or after surgery.

In order to prevent the development of reactive edema and postoperative complications the surgeon dentists often use cold besides the medicinal drugs [6, 10, 11]. Upon hypothermia the tissues show active vasoconstriction, decreased metabolism, slowing down the development of edema. Vasoconstriction is followed by the pronounced expansion of vessels, which leads to the development of active hyperemia, which, in turn, increases the phagocytic activity of leukocytes. It is also shown that local cooling has analgesic, hemostatic, desensitizing, anti-inflammatory and bacteriostatic action [11]. The repeated short contact cooling with a shallow (5-10°C) temperature lowering is accompanied by stimulation of protective tissue reactions and reparative processes. The surgeon dentists noted the enhancement of this effect upon combination of these methods, so the aim of this study was to improve the treatment of inflammatory complications by topical application of dexamethasone and hypothermia alone and combined in patients after third molars surgery and determination of the most effective method.

### Experimental Procedures

45 patients 18 to 30 years old who underwent surgery, i.e. atypical removal of teeth 38 or 48 for their retention and/or dystopia were subjected to our observation in the department of oral surgery of Chernivtsi Region Clinical Hospital.

The patients were divided into 4 groups. The first group was the control group where the standard medical therapy was applied during the postoperative period (antibiotic, antiedematous, anti-inflammatory); the patients in the second group were administered 4 mg of dexamethasone once intramuscularly (in the masticatory muscles), immediately after surgery. The patients of the third group were subjected to local hypothermia according to O.G. Pastukhov [10]. This method is specifically adapted in the surgical dentistry clinics. The cryopackages with the temperature of -15°C were used, the skin was cooled down to +20°-(+24°)C. The duration of treatment under this scheme is 30 minutes, with an interval of 2 to 4

hours. The treatment lasts for 5 days. The fourth group of patients underwent the combined use of hypothermia and dexamethasone. All patients were prescribed antibiotics.

The thermometric examination of patients of all groups and rheofaciography was performed. The study was conducted on Day 1, 3, 7, and 10 of the postoperative period.

The thermometric studies were performed using an electronic thermometer, DigitalProbe-Thermometer by TFA (Germany), which enables measuring the temperature with an accuracy of 0.01 degree according to Celsius. The thermometric method is an indirect but informative method of investigation in order to assess the degree of local inflammatory reaction and the rate of its extinction [12].

To study the hemodynamics of the postoperative area the rheographic research was conducted in the department of functional diagnostics of Chernivtsi Region Diagnostic Center. The tetrapolar rheographic technique was used in accordance with the recommendations of A.A. Prohanchukov [13]. The rheograms were recorded on Day 1, 3, 7, and 10 after surgery based on the length of wound healing periods.

The controls were 20 almost healthy people identical to the group of patients by age and sex.

The mathematical processing of the research results was carried out using the statistical module of Microsoft Excel 2000 package.

Significant differences between groups were considered at  $p < 0.05$ .

### Results and Discussion

The results of research on application of hypothermia and dexamethasone for treatment of postoperative complications after third molars surgery showed the positive course of the postoperative period, less expressive manifestations and accelerated rates of clinical symptoms extinction.

On the basis of analysis of the thermometric study indices it can be concluded that all patients during treatment show the positive local temperature changes, which differ in basic and control groups. Hyperthermia in the recovery area was more pronounced in all periods of

Table 2. Changes of rheological index in the basic and control groups (Ohms).

Day of the p/o period	First group (N = 10) (Control)		Second group (N = 11)			Third group (n = 11)			Fourth group (n = 13)		
	M±m	P <sub>1</sub>	M±m	P <sub>1</sub>	P <sub>2</sub>	M±m	P <sub>1</sub>	P <sub>2</sub>	M±m	P <sub>1</sub>	P <sub>2</sub>
Normal	0.024±0.001		0.024±0.001			0.024±0.001			0.024±0.001		
1	0.071±0.001	<0.05	0.057±0.001	<0.05	<0.05	0.061±0.001	<0.05	<0.05	0.051±0.001	<0.05	<0.05
3	0.046±0.001	<0.05	0.035±0.001	<0.05	<0.05	0.033±0.001	<0.05	<0.05	0.029±0.001	>0.05	<0.05
7	0.034±0.001	<0.05	0.026±0.001	>0.05	<0.05	0.028±0.001	>0.05	<0.05	0.023±0.001	>0.05	<0.05
10	0.025±0.001	>0.05	0.023±0.001	>0.05	>0.05	0.023±0.001	>0.05	>0.05	0.023±0.001	>0.05	>0.05

Note: P<sub>1</sub> - significance compared to the norm; P<sub>2</sub> - significance compared to the control group in the same period.

observation in the control group. On Day 1 after surgery the local temperature in the fourth group of patients differed from the normal only by 1.8°C. The most pronounced difference was registered on Day 3 after surgery, when the local temperature of the paravulnar area in the fourth group of patients differed from the normal by less than 1°C. On Day 7 the thermometry index in the fourth group corresponded to the original one, i.e. 34.01±0.01°C, in the second, third and control groups this figure was higher and amounted to 34.5±0.1°C, 34.61±0.014 and 34.79±0.016°C, respectively (Table 1). On Day 10 after surgery the local tissue temperature of the paravulnar area was normal in the patients of all groups. Thus, dexamethasone and local hypothermia have the most effective influence on the development of the inflammatory process upon their combined application.

The analysis of rheographic study findings helps to conclude about the dynamics of blood circulation restoration in the postoperative wound. On Day 1 after surgery the blood flow in the vessels was slightly decreased, the blood flow velocity was decreased due to the deterioration of venous outflow (decaying limb nature and appearance of additional waves) due to compression of veins caused by development of reactive edema (Table 2). The dynamics of rheological index change indicates that the least impaired blood flow in the recovery area was in the fourth group of patients; the recovery of tissue blood flow also was faster in this group of patients compared to the others. The hemodynamic improvement in the recovery area was indicated by a decrease of rheological index; on Day 3 the values of the fourth group only were closest to the normal values, and on Day 10 the values in all groups were normal.

### Conclusions

The results of thermometric and rheographic research provide an objective evidence of the fact that the topical application of dexamethasone and inclusion local hypothermia sessions in the postoperative therapy of patients helps reduce the intensity of inflammatory process symptoms, including the temperature in the postoperative areas, and accelerate the restoration of blood flow in

paravulnar area, providing the activation of reparative processes in damaged tissues.

The most effective of all used methods was the combination of the local intramuscular administration of dexamethasone and application of local hypothermia according to O.G. Pastukhov [3], which confirms the results of thermometry and rheographic study.

Having analyzed the research findings, it can be concluded that the treatment method for postoperative inflammatory complications of atypical removal of the lower wisdom teeth with local application of dexamethasone and cold is effective, most appropriate and promising for implementation in clinical practice of a dental surgeon.

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